

# Cluster-Based Economic Development

Christian H.M. Ketels, PhD  
Institute for Strategy and Competitiveness  
Harvard Business School

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This presentation draws on ideas from Professor Porter's articles and books, in particular, *The Competitive Advantage of Nations* (The Free Press, 1990), "Building the Microeconomic Foundations of Competitiveness," in *The Global Competitiveness Report 2002*, (World Economic Forum, 2002), "Clusters and the New Competitive Agenda for Companies and Governments" in *On Competition* (Harvard Business School Press, 1998), the *Clusters of Innovation Initiative*, a joint effort of the Council on Competitiveness, Monitor Group, and Professor Porter, and ongoing research on rural regions sponsored by the Economic Development Agency (EDA). No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means - electronic, mechanical, photocopying, recording, or otherwise - without the permission of Michael E. Porter.

Further information on Professor Porter's work and the Institute for Strategy and Competitiveness is available at [www.isc.hbs.edu](http://www.isc.hbs.edu)

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# The United States Economy 2003

- The U.S. economy is in the midst of a classic **macroeconomic** business cycle downturn
  - Short term rebound subdued by imbalances in private sector balance sheets
  - Medium term risk from imbalances in the current account
- The **microeconomic foundations** of the U.S. economy, however, remain strong
  - Overall, the United States is the most competitive business location in the global economy (Global Competitiveness Report 2002-03)

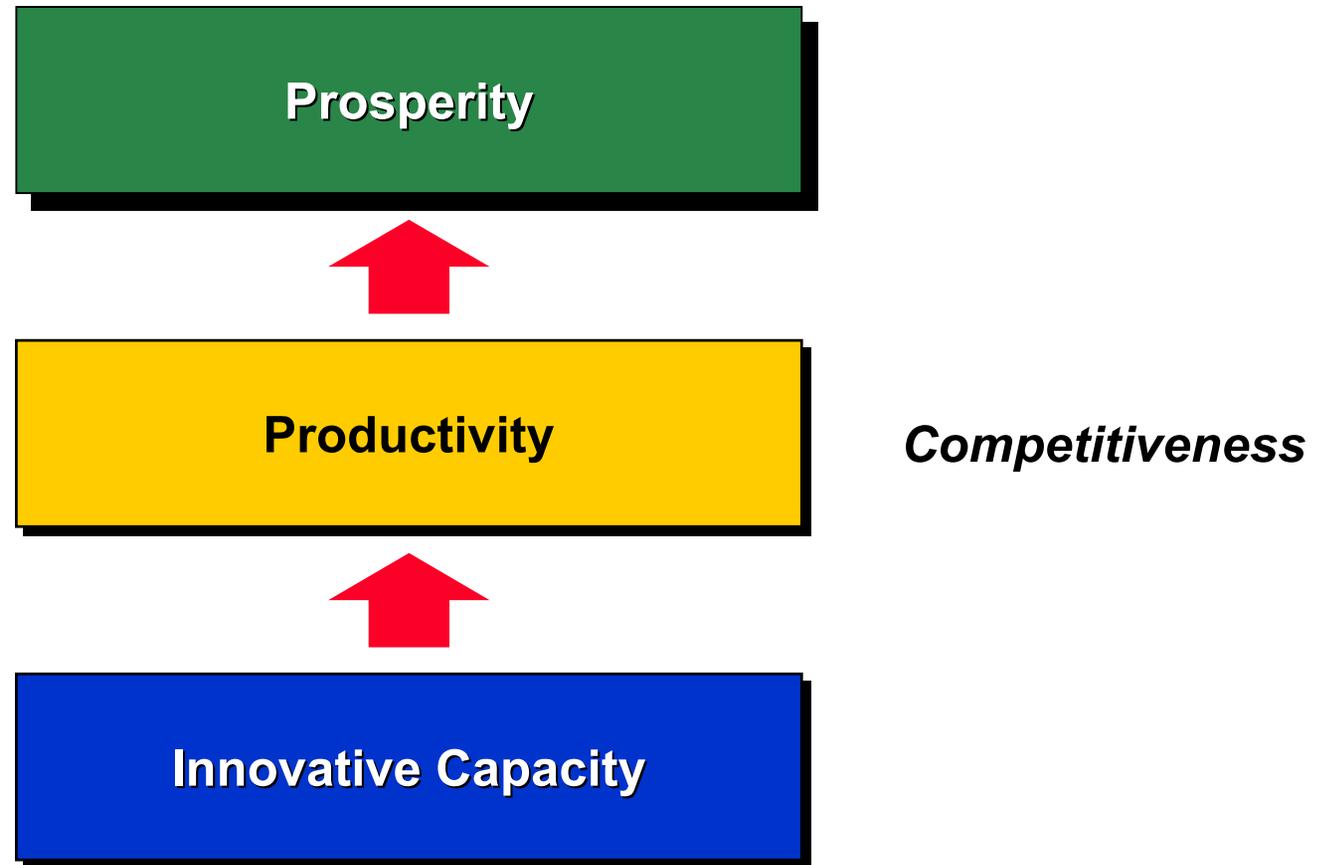


- The United States' lead in competitiveness needs to be **earned** again every day; cluster-based development approaches are important in this process
  - Need to manage budget pressure on all public sector levels to avoid undermining competitiveness

# Topics

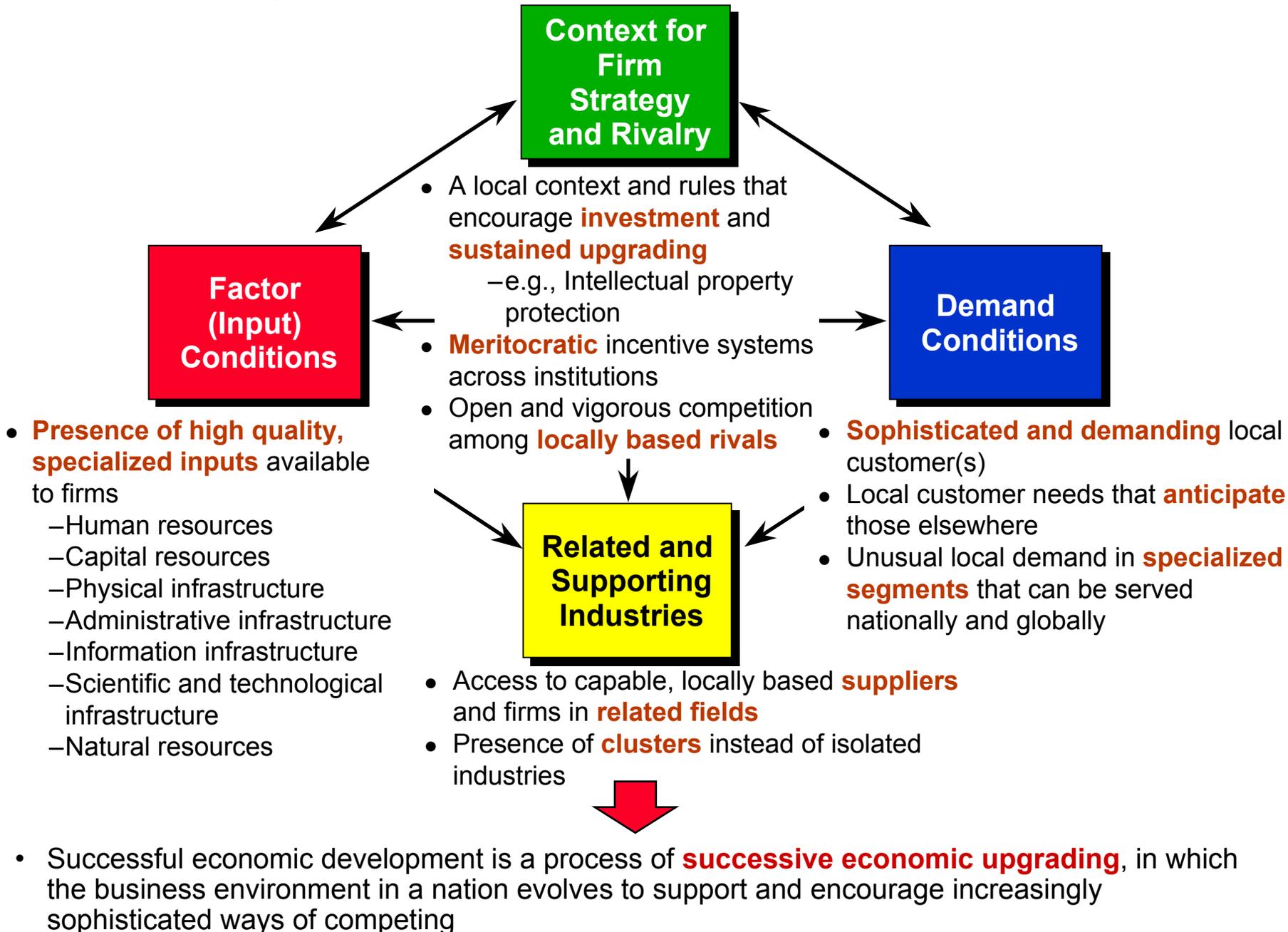
- **Microeconomic Foundations of Competitiveness**
- A Closer Look at Clusters
- From Analysis to Action: Clusters as a Tool for Economic Policy

# Innovation and Competitiveness

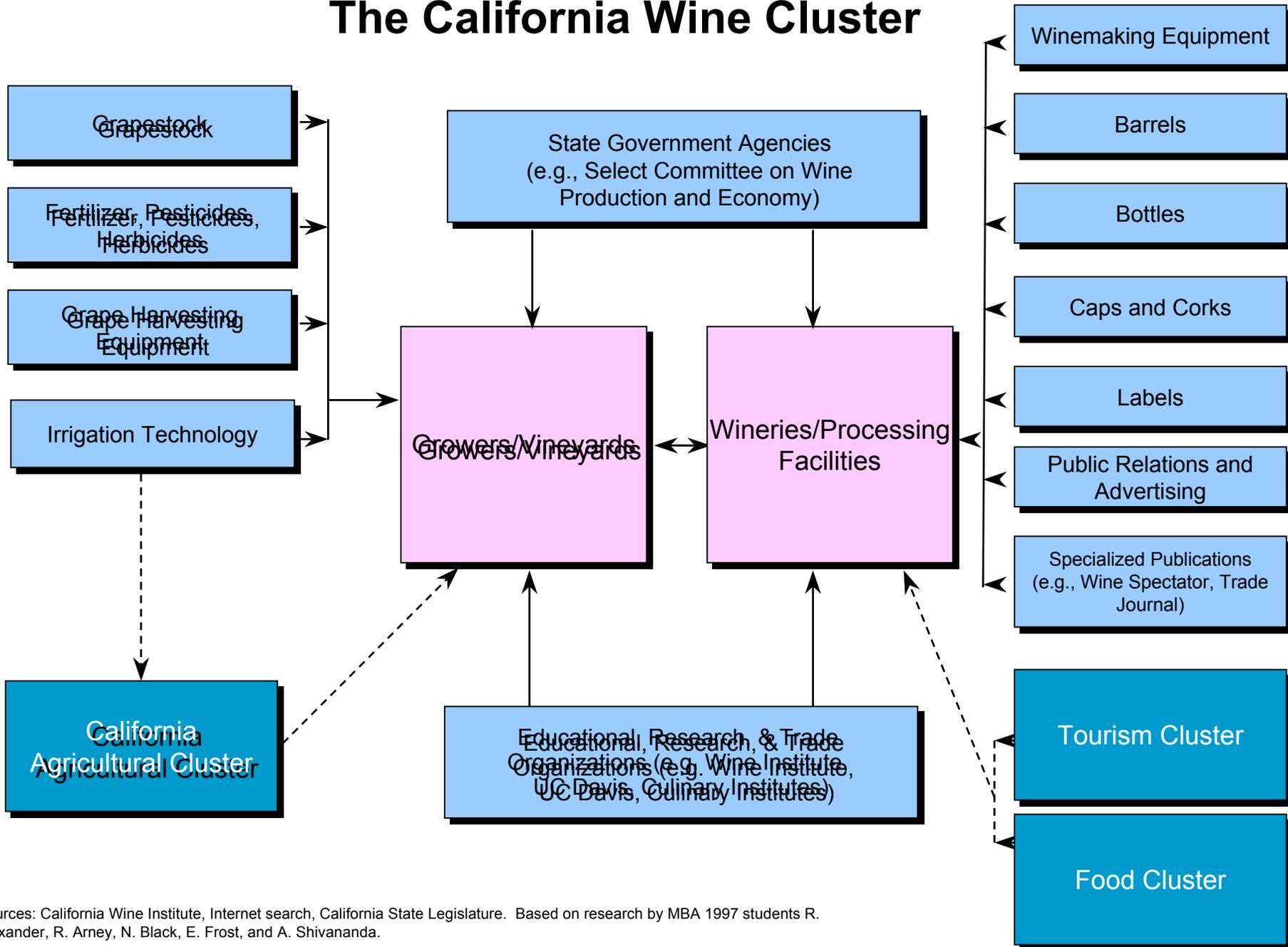


- Innovation is vital for **long-term increases** in productivity
- Innovation is **more than just scientific discovery**
- There are **no low-tech industries**, only low-tech firms

# Productivity, Innovation, and the Business Environment



# The California Wine Cluster



Sources: California Wine Institute, Internet search, California State Legislature. Based on research by MBA 1997 students R. Alexander, R. Arney, N. Black, E. Frost, and A. Shivananda.

# Clusters and Competitiveness

- **Clusters Increase Productivity / Efficiency**

- Efficient **access** to specialized inputs, services, employees, information, institutions, and “public goods” (e.g. training programs)
- Ease of **coordination** and transactions across firms
- Rapid **diffusion** of best practices
- Ongoing, visible **performance comparisons** and strong incentives to improve vs. local rivals

- **Clusters Stimulate and Enable Innovations**

- Enhanced ability to **perceive innovation opportunities**
- Presence of multiple suppliers and institutions to assist in **knowledge creation**
- Ease of **experimentation** given locally available resources

- **Clusters Facilitate Commercialization**

- Opportunities for **new companies** and **new lines of established business** are more apparent
- **Commercializing** new products and starting new companies is easier because of available skills, suppliers, etc.



Clusters reflect the fundamental influence of **externalities / linkages** across firms and associated institutions in competition

# Institutions for Collaboration

## *General*

- Chambers of Commerce
- Professional associations
- School networks
- University partner groups
- Religious networks
- Joint private/public advisory councils
- Competitiveness councils

## *Cluster-specific*

- Industry associations
- Specialized professional associations and societies
- Alumni groups of core cluster companies
- Incubators

- Institutions for collaboration (IFC) are **formal and informal organizations** that
  - facilitate the exchange of information and technology
  - conduct joint activities
  - foster coordination among firms
- IFCs can improve the business environment by
  - creating **relationships** and level of trust that make them more effective
  - defining of **common standards**
  - conducting or facilitating the organization of **collective action** in areas such as procurement, information gathering, or international marketing
  - defining and communicating common **beliefs and attitudes**
  - providing mechanisms to develop a common economic or **cluster agenda**

# Patents by Organization

## Commonwealth of Massachusetts

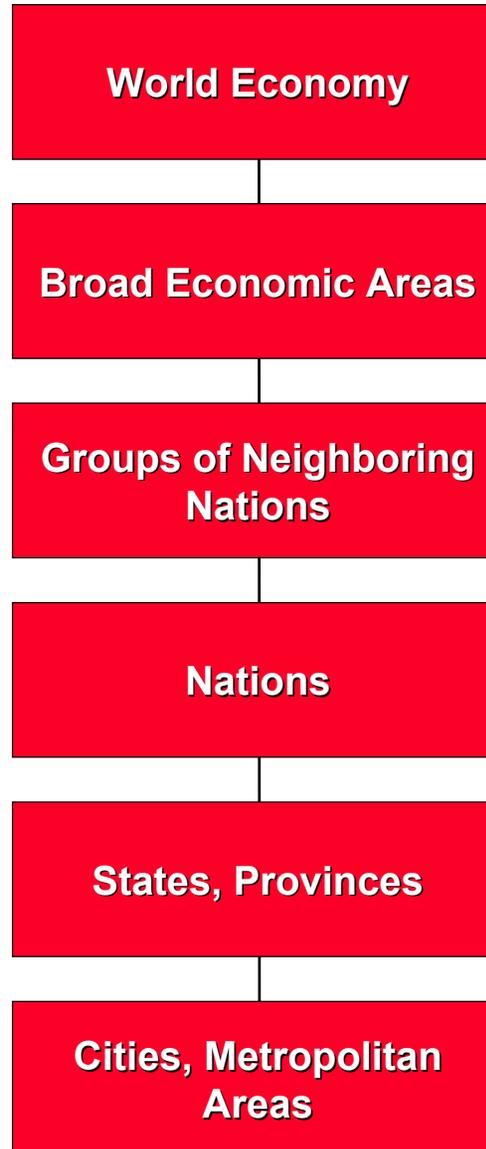
	Organization	Patents Issued from 1997 to 2001
1	<b>MASSACHUSETTS INSTITUTE OF TECHNOLOGY</b>	<b>518</b>
2	<b>GENERAL HOSPITAL CORPORATION</b>	<b>296</b>
3	EMC CORPORATION	269
4	DIGITAL EQUIPMENT CORPORATION	261
5	POLAROID CORPORATION	213
6	ANALOG DEVICES, INC.	167
7	MILLENNIUM PHARMACEUTICALS, INC.	165
8	<b>HARVARD UNIVERSITY</b>	<b>150</b>
9	COMPAQ COMPUTER CORPORATION, INC.	147
10	SUN MICROSYSTEMS, INC.	143
11	BOSTON SCIENTIFIC CORPORATION	135
12	ACUSHNET COMPANY	130
13	GENETICS INSTITUTE, INC.	127
14	GILLETTE COMPANY	112
15	<b>BRIGHAM AND WOMEN'S HOSPITAL</b>	<b>107</b>
16	RAYTHEON COMPANY	101
17	GENERAL ELECTRIC COMPANY	99
18	HEWLETT-PACKARD COMPANY	96
19	<b>CHILDREN'S MEDICAL CENTER CORPORATION</b>	<b>93</b>
20	QUANTUM CORP. (CA)	93
21	COGNEX CORPORATION	90
22	<b>DANA-FARBER CANCER INSTITUTE</b>	<b>90</b>
23	JOHNSON & JOHNSON PROFESSIONAL INC.	90
24	<b>BOSTON UNIVERSITY</b>	<b>84</b>
25	SEPRACOR INC.	84

Note: Shading indicates universities, research institutions, and other government agencies

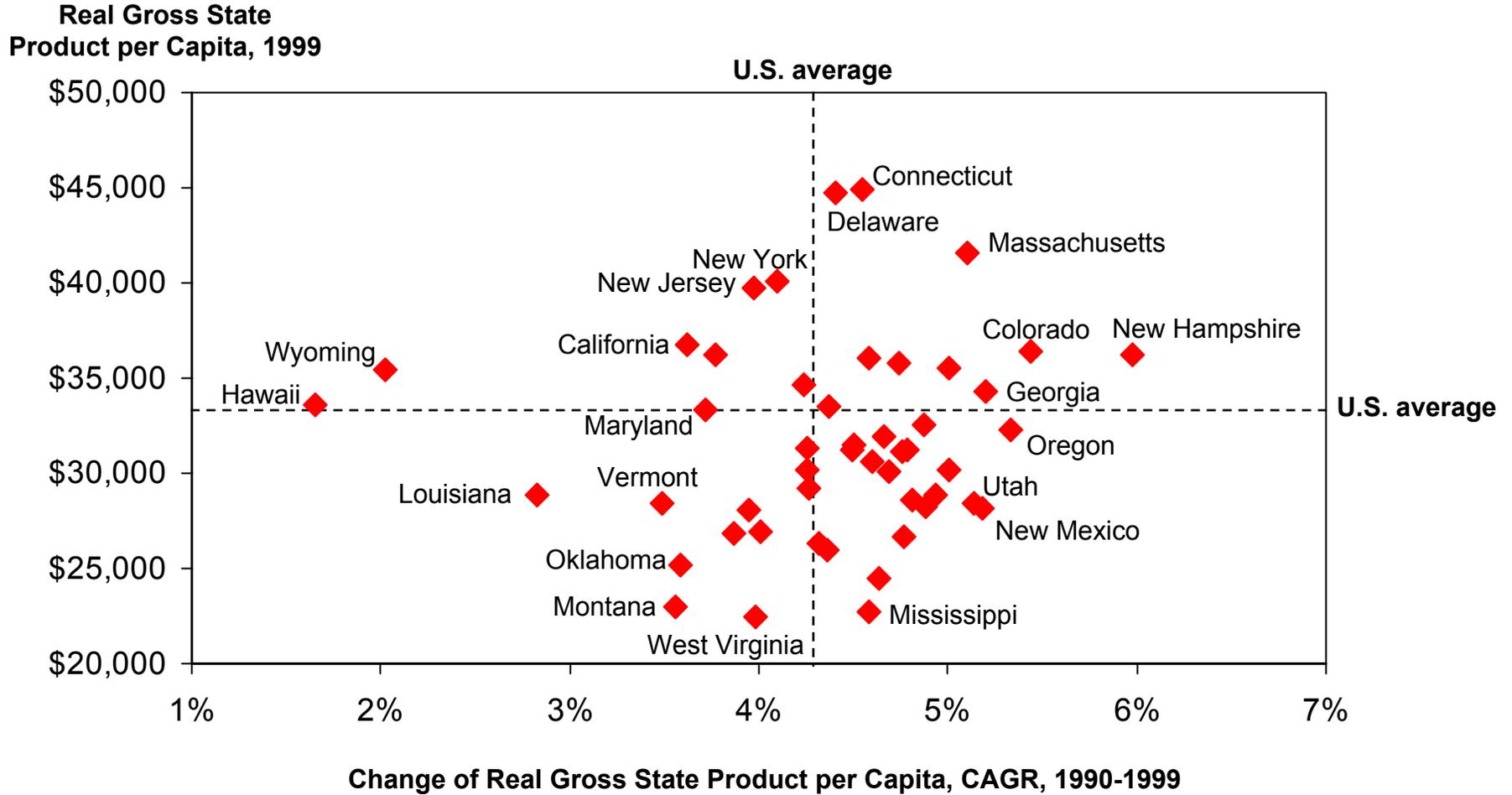
Source: US Patent and Trademark Office ([www.uspto.gov](http://www.uspto.gov)). Author's analysis.

# Influences on Competitiveness

## Multiple Geographic Levels

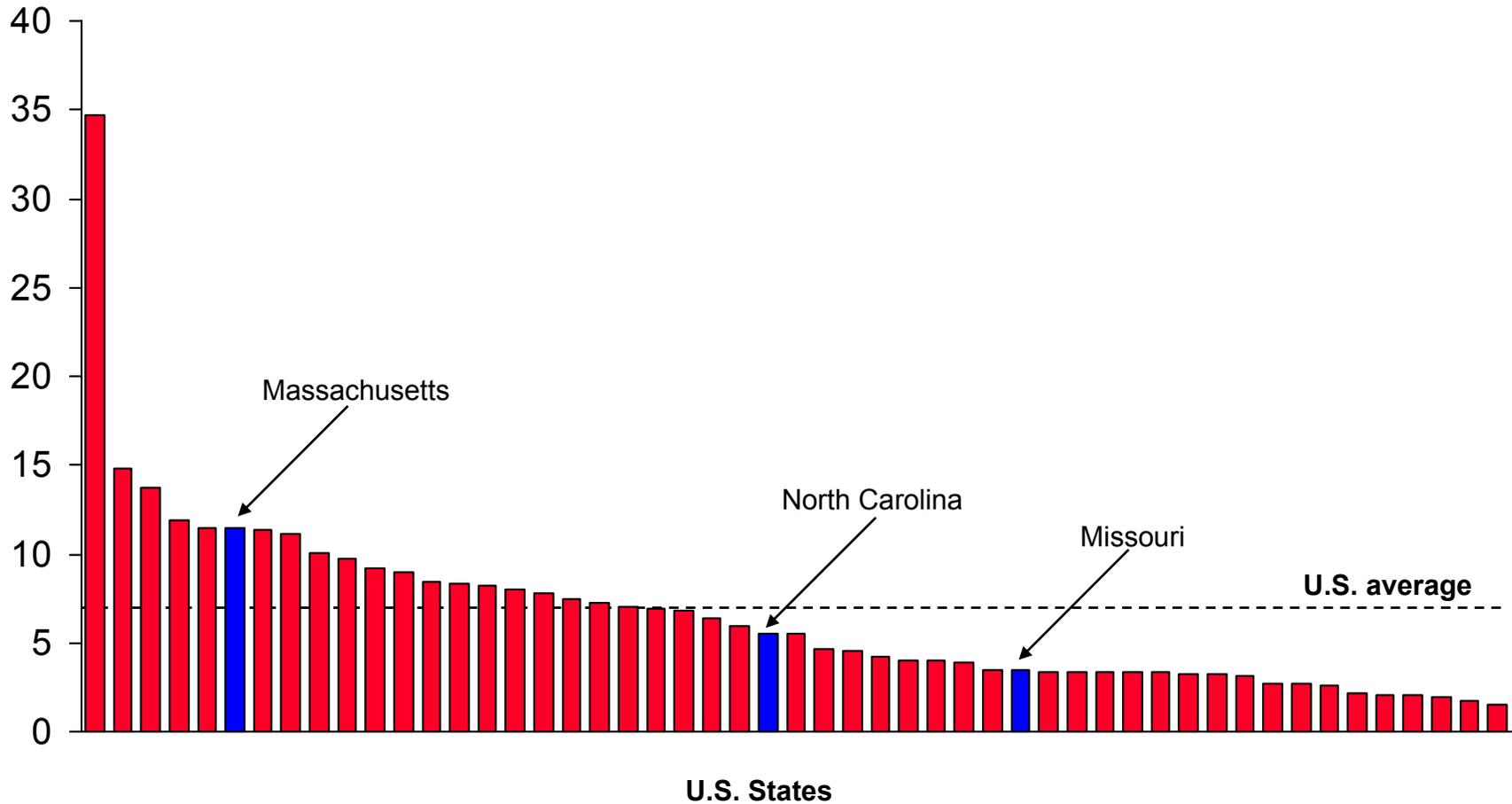


# Economic Performance Across U.S. States



# Innovation Performance Across U.S. States

Patents per  
100,000 Inhabitants, 2000



Source: Cluster Mapping Project (<http://data.isc.hbs.edu/isc/index.jsp>)

# Topics

- Microeconomic Foundations of Competitiveness
- **A Closer Look at Clusters**
- From Analysis to Action: Clusters as a Tool for Economic Policy

# Broad Cluster Types in Regional Economies

## United States

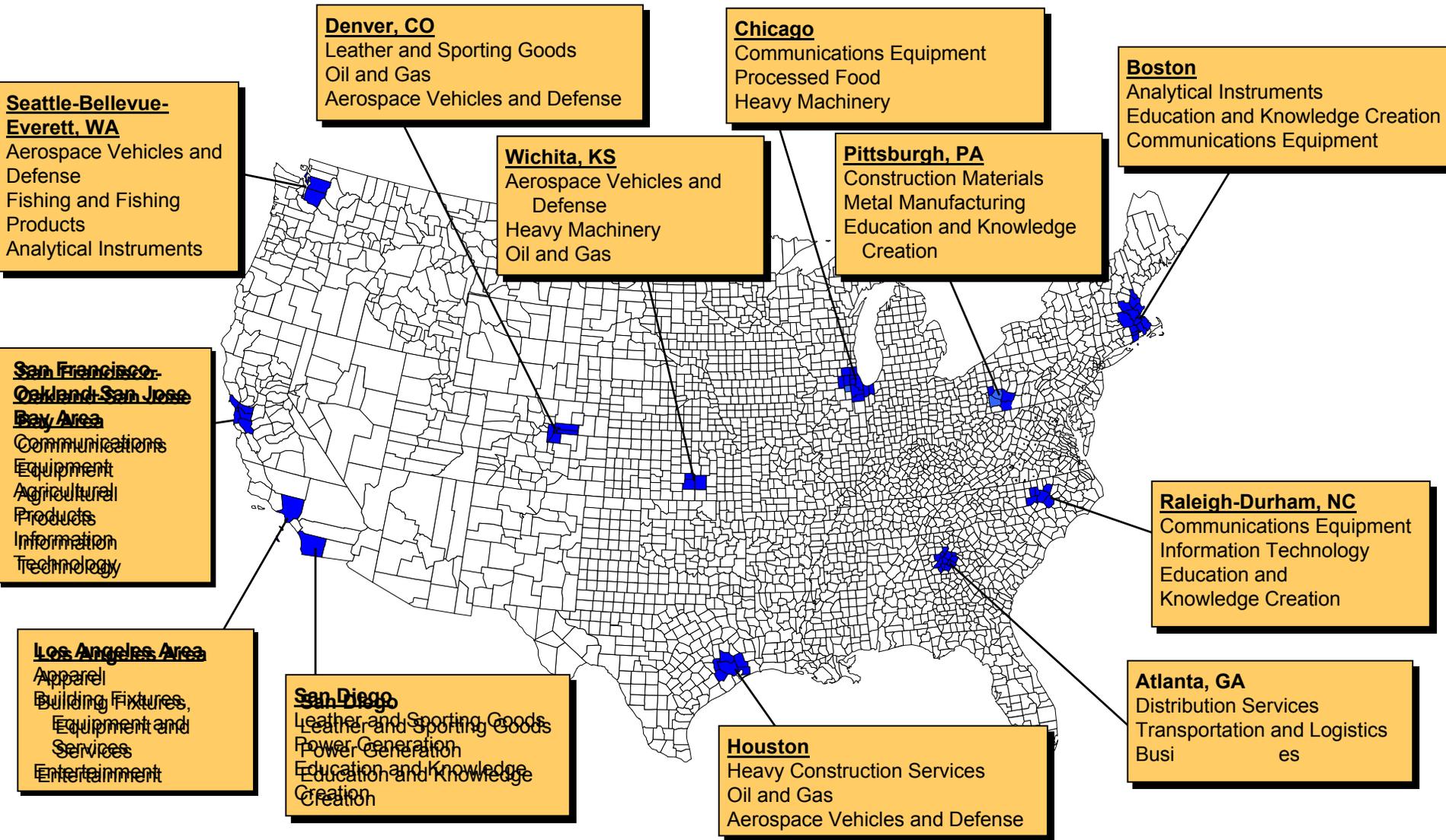
	Traded Clusters	Local Clusters	Natural Resource-Driven Industries
<b>Share of Employment</b>	<b>31.8%</b>	<b>67.1%</b>	<b>0.8%</b>
<b>Employment Growth, 1990 to 2000</b>	<b>1.7%</b>	<b>2.8%</b>	<b>-1.0%</b>
<b>Average Wage</b>	<b>\$45,040</b>	<b>\$27,169</b>	<b>\$32,169</b>
<b>Relative Wage</b>	<b>137.0</b>	<b>82.6</b>	<b>97.7</b>
<b>Wage Growth</b>	<b>5.0%</b>	<b>3.6%</b>	<b>1.9%</b>
<b>Relative Productivity</b>	<b>144.1</b>	<b>79.3</b>	<b>140.1</b>
<b>Patents per 10,000 Employees</b>	<b>21.1</b>	<b>1.3</b>	<b>7.0</b>
<b>Number of SIC Industries</b>	<b>590</b>	<b>241</b>	<b>48</b>

Note: 2000 data, except relative productivity which is 1997 data.

Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

# Cluster Composition in Regional Economies

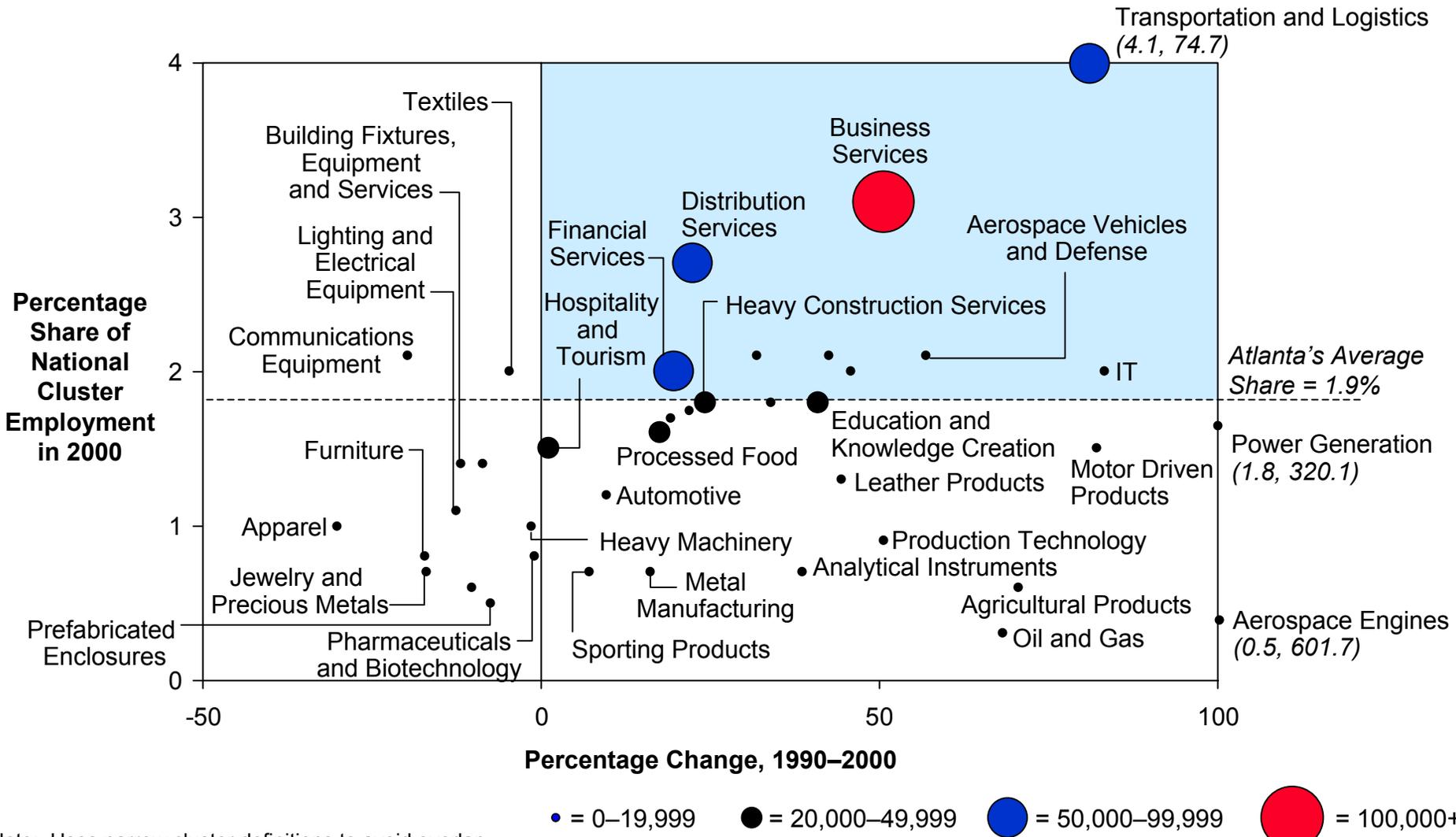
## Selected U.S. Regions



Note: Clusters listed are the three highest ranking clusters in terms of share of national employment  
 Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

# Cluster Specialization of Regional Economies

## Atlanta Metro Region

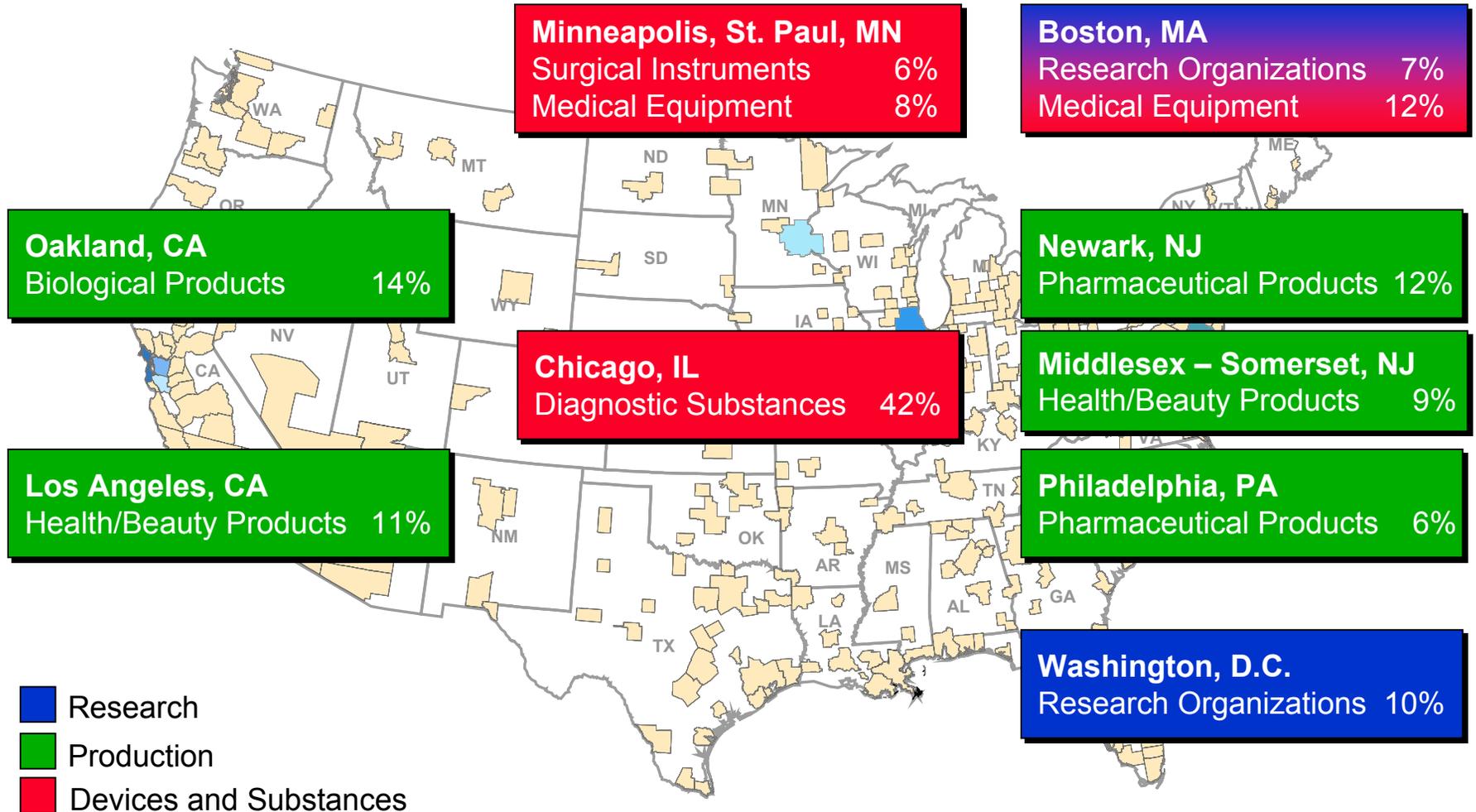


Note: Uses narrow cluster definitions to avoid overlap

Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

# Leading Life Sciences Clusters

## Regional Share of National Subcluster Employment



Note: All 318 Metropolitan Areas are shown in pink; includes subclusters in which the MA has employment rank 1 or 2 nationally, 1999 data

Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

# Levels of Clusters

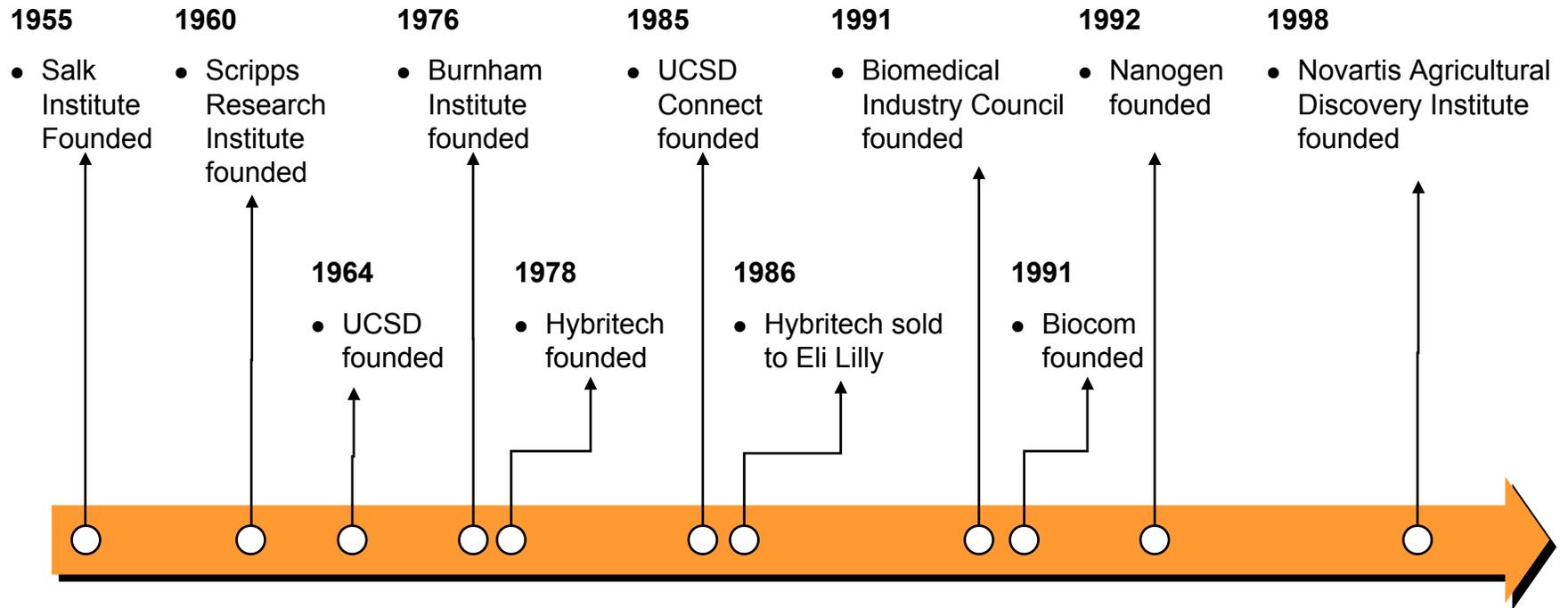
- There is often an **array of clusters** in a given field in different locations, each with different levels of specialization and sophistication
- Global **innovation centers**, such as Silicon Valley in semiconductors, are few in number. If there are multiple innovation centers, they normally **specialize** in different market segments
- Other clusters focus on **manufacturing**, outsourced **service functions**, or play the role of **regional** assembly or service centers
- Firms based in the most advanced clusters often **seed or enhance clusters** in other locations in order to reduce the risk of a single site, access lower cost inputs, or better serve particular regional markets
- The challenge for an economy is to move from **isolated firms** to an array of **clusters**, and then to **upgrade the breadth and sophistication** of clusters to more advanced activities



- Cluster-based development provides opportunities to **all regions**, not only the most advanced regions

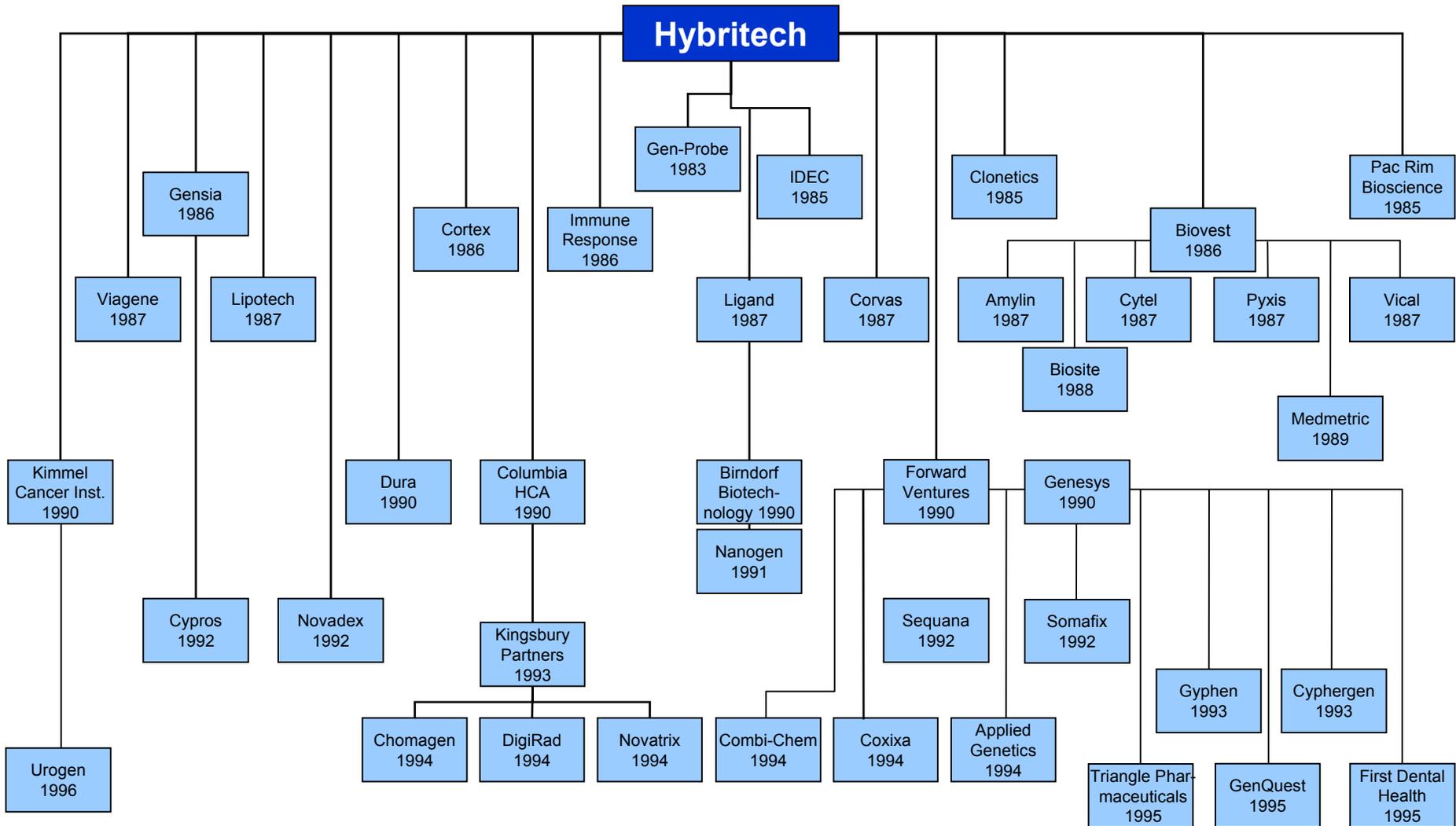
# The Process of Cluster Development

## History of the San Diego Biotech / Pharma Cluster



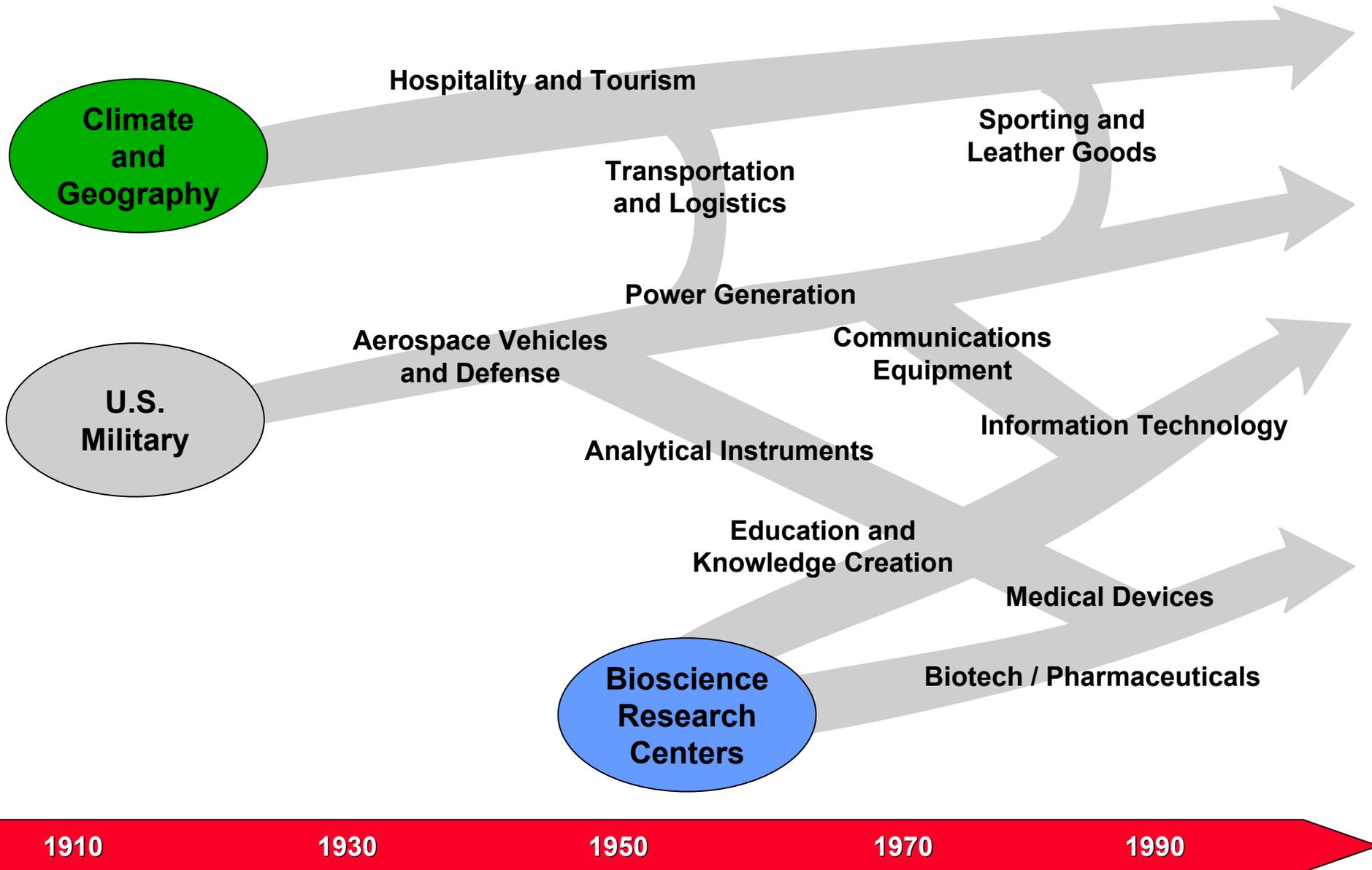
# Anchor Companies

## Spin-outs in the San Diego Biotech / Pharma Cluster



Source: CONNECT, University of California, San Diego

# The Military, Climate, and Research in San Diego



1910

1930

1950

1970

1990

# Topics

- Microeconomic Foundations of Competitiveness
- A Closer Look at Clusters
- **From Analysis to Action: Clusters as a Tool for Economic Policy**

# Achieving Competitiveness

## The Role of Clusters

- A country's or region's future **competitiveness** depends on progress in two dimensions
  - Cross-cluster issues affecting the whole economy
  - Clusters
- Clusters provide the opportunity to move to a new level of **private-public partnership**. They can also be a **test-ground** for developing solutions to economy wide problems

### However

- Cluster initiatives alone are less effective, if they are not part of a **overarching approach** to improve competitiveness on the national and/or regional level

# Clusters as a Tool For Economic Policy

## Overview

- A **new way of thinking** about an economy and organizing economic development efforts
- Better aligned with the **nature of competition and sources of competitive advantage**. Clusters capture important **linkages** in terms of technology, skills, information, marketing and customer needs that cut across firms and industries. Such linkages are fundamental to competition and, especially, to the **direction and pace of innovation**
- **Recast the role** of the private sector, government, trade associations and educational or research institutions
- Brings together **firms of all sizes**
- Creates a **forum** for constructive business-government dialog
- A means to identify **common opportunities, not just common problems**
- Provides guidance for both **economic and social policies**

# Cluster Development Initiatives

## Critical Success Factors

- Cluster definition
  - Cluster definitions need to be **broad enough** to include all relevant industries and institutions that have material linkages with the core activities of the cluster
  - Cluster definitions need to be **narrow enough** to cover companies that face a common set of barriers to upgrade productivity and performance
- Cluster selection
  - Competitiveness depends on **all clusters** a region or nation is active in
  - Prioritization of cluster efforts should be based upon the **potential and willingness to upgrade** of the regional cluster instead of generic, location-independent factors

# Cluster Development Initiatives

## Critical Success Factors (Continued)

- Objectives
  - Cluster initiatives need to have a defined **hierarchy of measurable goals**, from activities to intermediate goals to ultimate goals
  - The focus of the initiative should be on **increasing productivity**, not on increasing the size of the cluster
- Activities
  - All activities need to be considered that can increase the potential for productivity and productivity growth, not only **financial incentives**
  - **Data-driven analysis** should be used extensively to allow a more rational discussion about threats and opportunities for the cluster
  - The analysis should be used to identify **priorities for action**, not to rank the cluster for marketing purposes

# Cluster Development Initiatives

## Critical Success Factors (Continued)

- Structure
  - Only **sustained, private sector-led** cluster initiatives can be sufficiently specific and persistent in their activities to achieve real improvements in cluster performance
  - All relevant parts of public administration and the legislature need to be involved to insure **broad backing** and **quick implementation** of recommendations
  - **Leadership** by a committed individual is need to keep momentum and integrate individual constituencies into a common upgrading process
  - Independent **institutional structures** are often helpful to sustain momentum over time; universities and cluster organizations can be useful to play this role
  - The integration of a cluster effort in a broader **regional competitiveness initiative** increases its impact

# Common Pitfalls

## Cluster Initiatives

- Prioritize clusters based on generic classifications (“high value added”) rather than local potential and willingness to upgrade
- Using the cluster concept as a cover for intervention and industrial policy
- Overly broad or overly narrow cluster definitions
- Orientation towards subsidies or limiting competition
- Ignoring small, emerging, or traditional clusters
- Attempting to create clusters where there is no foundation

# Different Approaches to Cluster Development

## Cluster Creation

- Targets areas of perceived **market demand**
- Is driven by **public sector intervention**
- Requires sustained **financial commitment** by the public sector
- High **failure rate**



- **Deepens** the dependence on public sector intervention

## Cluster Activation

- Leverages **existing assets**, history, and geographic location
- Builds on **coalition** of private and public sector actors
- Requires sustained **participation** by all actors
- Level of success is increasing over **time**; quick returns are possible

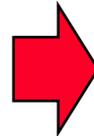


- **Transforms** the roles of private and public sector

# Shifting Responsibilities for Economic Development

## Old Model

- **Government** drives economic development through policy decisions and incentives



## New Model

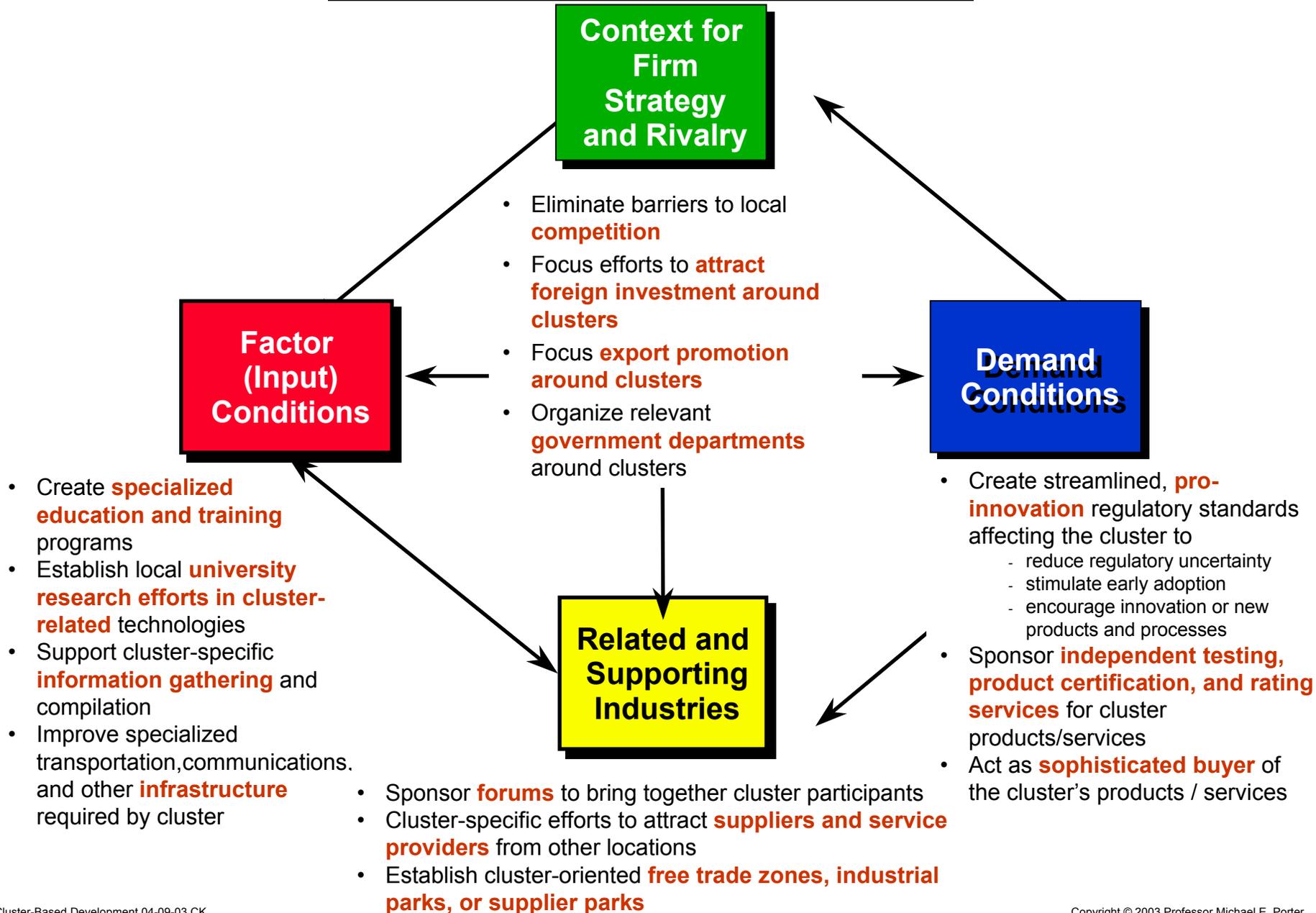
- Economic development is a **collaborative process** involving government at multiple levels, companies, teaching and research institutions, and institutions for collaboration

# Appropriate Roles of Government in Cluster Development

- A successful cluster policy builds on **sound overall economic policies**
- Government should support the development of **all clusters**, not choose among them
- Government policy should **reinforce established and emerging clusters** rather than attempt to create entirely new ones
- Government's role in cluster initiatives is as **facilitator** and **participant**. The most successful cluster initiatives are a public-private partnership

# The Role of Government in Cluster Development

## Illustrative Cluster-Specific Policies



# Government Roles on Different Geographic Levels

## Federal

- Set the **context** through macroeconomic policy and microeconomic rules
- Upgrade business environment conditions under national control
- **Enable** regional competitiveness efforts

## State

- **Initiate and facilitate** state and cluster competitiveness efforts
- Upgrade **business environment conditions** under state control
- Support local competitiveness efforts

## Local

- **Participate** in regional and cluster competitiveness efforts
- Upgrade business environment conditions under local control

# Role of the Private Sector in Economic Development

- A company's competitive advantage is partly the result of the **local environment**
- Company membership in a cluster offers **collective benefits**
- Private investment in **“public goods”** is justified

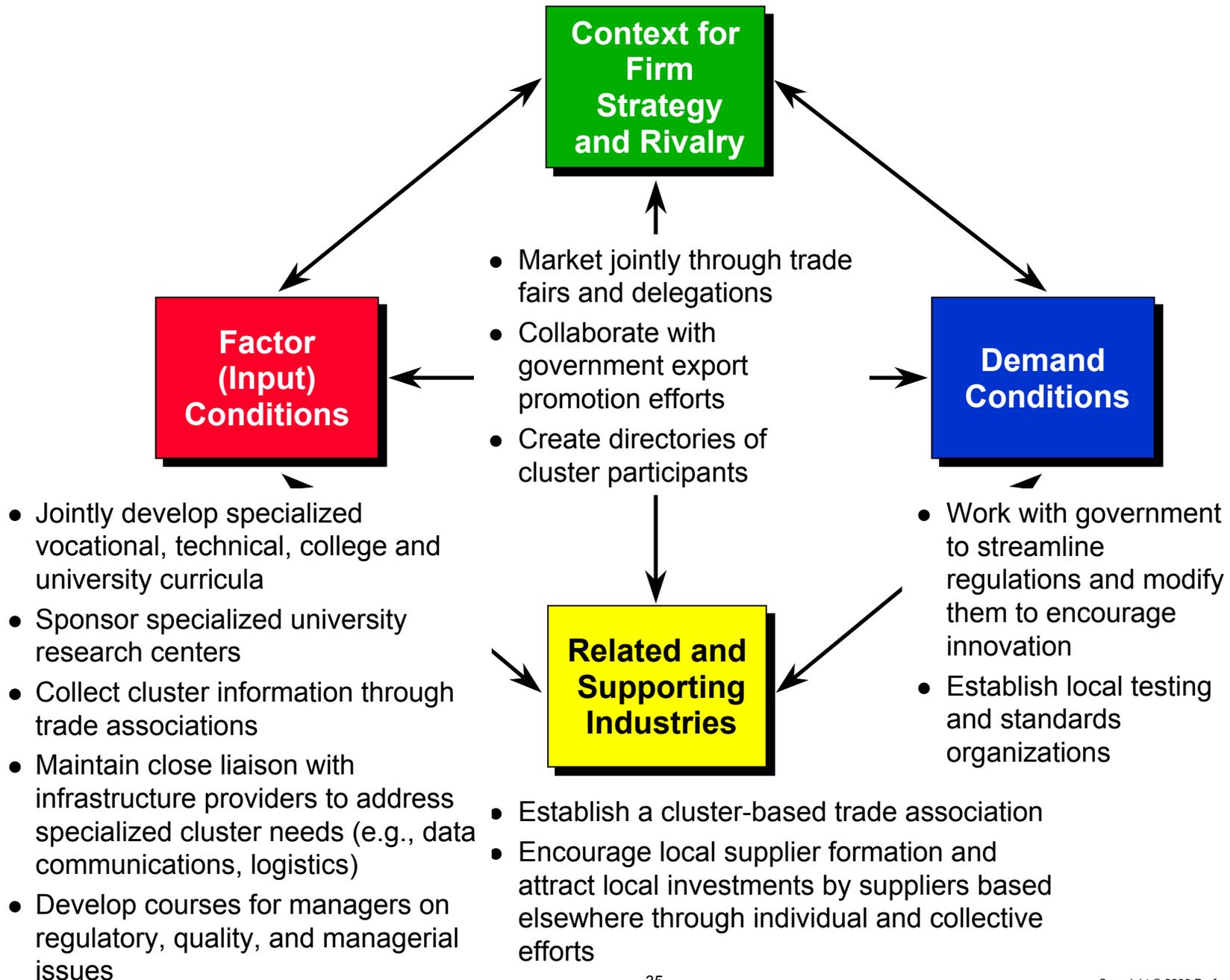


- Take an **active role** in upgrading the local infrastructure
- Nurture **local suppliers** and attract new supplier investments
- Work closely with local **educational and research institutions** to upgrade **quality and create specialized programs addressing cluster needs**
- Provide government with **information** and **substantive input** on regulatory issues and constraints bearing on cluster development
- Focus **corporate philanthropy** on enhancing the local business environment



- An important role for **trade associations**
  - Greater influence
  - Cost sharing

# Private Sector Influences on Cluster Upgrading



# New Roles of Industry Associations

## Traditional Roles

- Lobby government
  - Trade and regulations
- Convene meetings for networking

## New Roles

- Negotiate with government
  - Trade and regulations
- Information collection and dissemination
  - E.g. regular benchmarking
- Joint marketing
  - E.g. trade fairs, missions
- Training
  - E.g. curriculum for managers
  - Close collaboration with outside educational institutions
  - Sponsoring of targeted scholarships
- Research
  - E.g. university partnerships
  - Standard setting and testing
  - Specialized research institutes
- Procurement
  - E.g. joint purchasing programs
- Environmental
  - E.g. demonstration projects
  - Research sponsorship



**Cluster activation and enabling**

# New Roles of Universities and Research Organizations

- Universities and non-profit research institutions need to **cooperate** actively with co-located companies and other institutions, pursuing their role as **part of the regional business environment**
    - Different objectives of universities and companies need to be **managed**, not assumed away or taken as an excuse for ‘ivory tower’-isolation
  - Key roles for universities
    - Joint generation and transfer of **knowledge**
    - **Workforce** development
    - **Facilitation** of competitiveness initiatives
- 
- Universities more engaged in the upgrading of their regional business environments reap direct **benefits** apart from a more prosperous home region
    - Higher attractiveness for staff and students
    - Higher impact of research and education

# Cluster-Based Development in Challenging Times

- Less **resources** for cluster-based economic development
  - Preoccupation with solving the short-term budget pressure
- Lower **willingness** by companies to engage in cooperative efforts

## However

- Chance to concentrate on **critical initiatives** with high expected return
- Need to create **private-public coalitions** to support efforts not sustainable with public funds alone



- Strong **leadership** will be critical to make the challenging economic environment an opportunity for better cluster-based development efforts

# Back-Up

# Total Employment in Traded Clusters

## United States

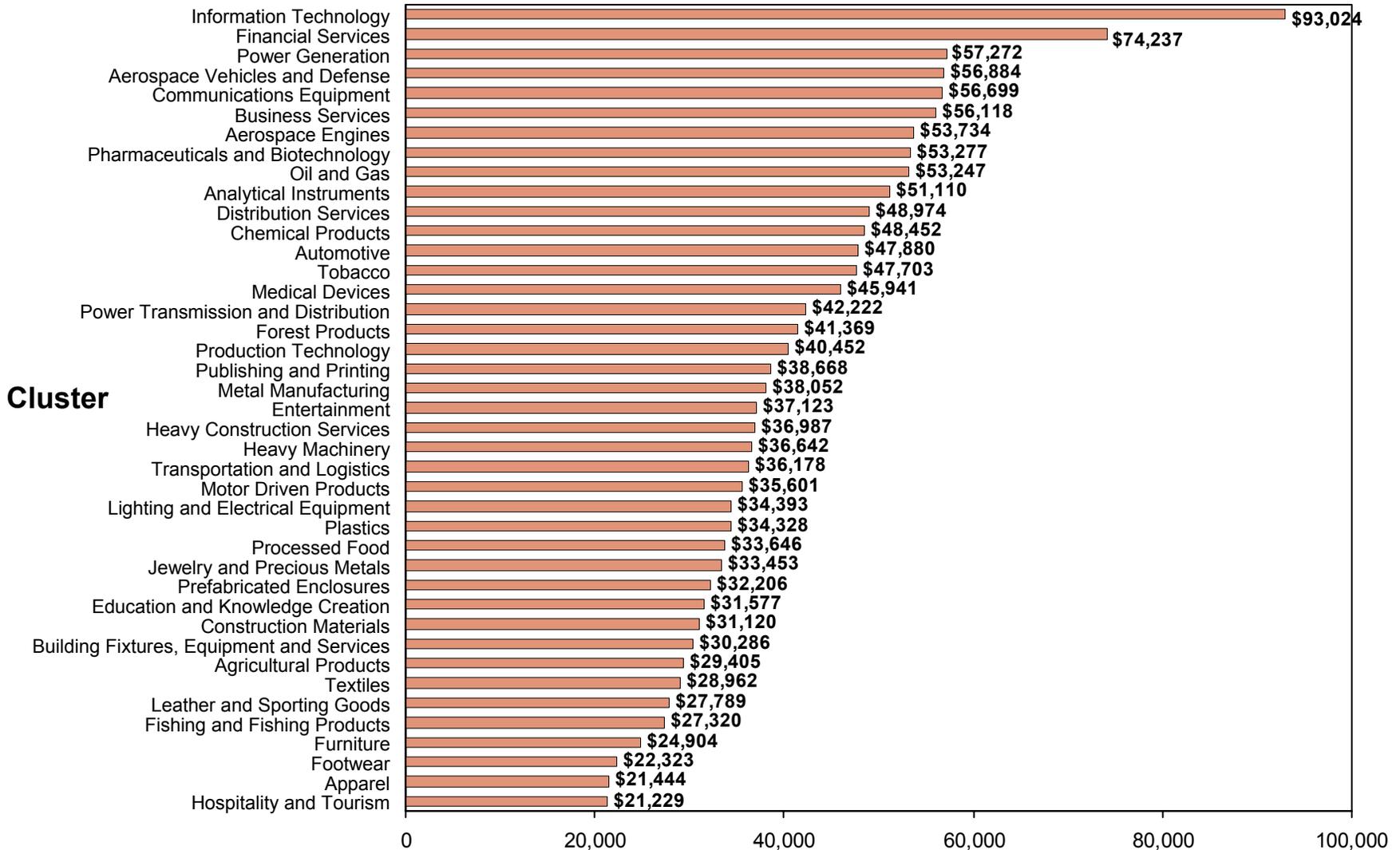
	Cluster	2000 Employment	Percent of Total U.S. Employment
1	Business Services	4,667,320	4.23%
2	Financial Services	3,242,151	2.94%
3	Hospitality and Tourism	2,565,077	2.33%
4	Education and Knowledge Cr.	2,246,974	2.04%
5	Distribution Services	1,962,523	1.78%
6	Heavy Construction Services	1,883,271	1.71%
7	Transportation and Logistics	1,644,641	1.49%
8	Metal Manufacturing	1,412,368	1.28%
9	Processed Food	1,388,073	1.26%
10	Automotive	1,386,153	1.26%
11	Entertainment	1,057,193	0.96%
12	Publishing and Printing	983,152	0.89%
13	Plastics	874,482	0.79%
14	<b>Information Technology</b>	<b>860,230</b>	<b>0.78%</b>
15	Analytical Instruments	744,832	0.68%
16	Building Fixtures, Equ. & Ser.	670,048	0.61%
17	Production Technology	665,382	0.60%
18	Apparel	559,276	0.51%
19	Chemical Products	438,967	0.40%
20	<b>Communications Equipment</b>	<b>425,332</b>	<b>0.39%</b>
21	Heavy Machinery	411,940	0.37%

	Cluster	2000 Employment	Percent of Total U.S. Employment
22	Motor Driven Products	408,427	0.37%
23	Textiles	402,839	0.37%
24	Forest Products	392,080	0.36%
25	Furniture	379,108	0.34%
26	<b>Medical Devices</b>	<b>372,442</b>	<b>0.34%</b>
27	Oil and Gas Products & Ser.	370,192	0.34%
28	<b>Aerospace Veh. and Def.</b>	<b>367,315</b>	<b>0.33%</b>
29	Lighting and Electrical Equ.	329,723	0.30%
30	Prefabricated Enclosures	317,080	0.29%
31	Power Generation & Trans.	290,896	0.26%
32	Agricultural Products	265,260	0.24%
33	<b>Biopharmaceuticals</b>	<b>264,319</b>	<b>0.24%</b>
34	Construction Materials	199,051	0.18%
35	Leather Products	133,253	0.12%
36	Jewelry and Precious Metals	126,621	0.11%
37	Sport., Recr. & Childr. Gds.	107,064	0.10%
38	<b>Aerospace Engines</b>	<b>94,360</b>	<b>0.09%</b>
39	Fishing and Fishing Products	51,222	0.05%
40	Tobacco	43,843	0.04%
41	Footwear	23,962	0.02%
	<b>TOTAL</b>	<b>35,028,441</b>	<b>31.78%</b>

**Clusters usually referred to as “high tech” make up 6.8% of traded employment and 2.2% of total U.S. employment**

# Average Wages in Traded Clusters

## United States



2000 Average Wage

# Web resources

Institute for Strategy and Competitiveness

[www.isc.hbs.edu](http://www.isc.hbs.edu)

ISC Cluster Mapping Data (US)

[data.isc.hbs.edu/isc/index.jsp](http://data.isc.hbs.edu/isc/index.jsp)

## *Cluster of Innovation Initiative*

- Council on Competitiveness
- Monitor Company

[www.compete.org](http://www.compete.org)

[www.monitor.com](http://www.monitor.com)